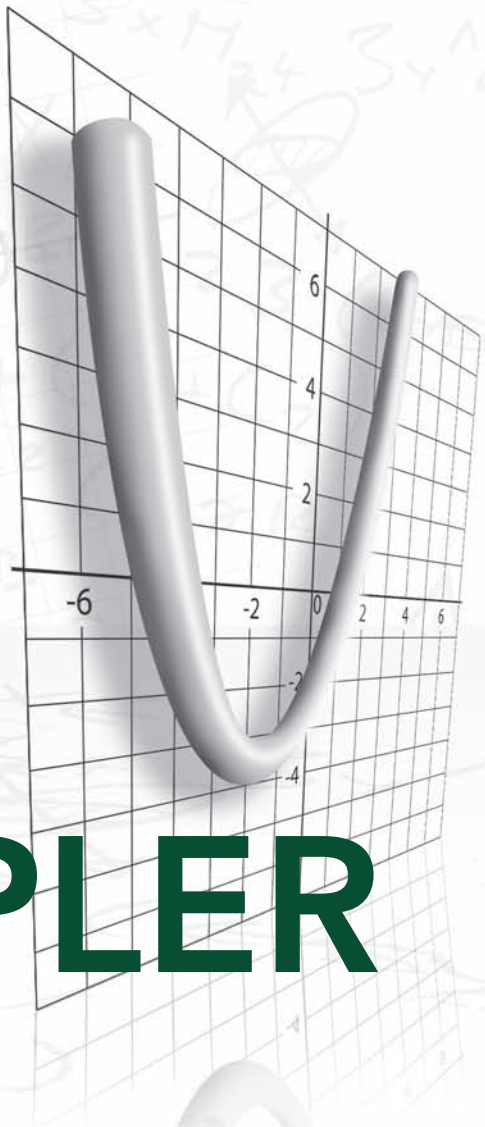
Student Name _____

Teacher Name _____

School _____

System _____



ALGEBRA II

ITEM SAMPLER

Tennessee End of Course Assessment
Algebra II

Developed and published under contract with State of Tennessee Department of Education by the Educational Measurement group of Pearson, a business of NCS Pearson, Inc., 2510 North Dodge Street, Iowa City, Iowa 52245.

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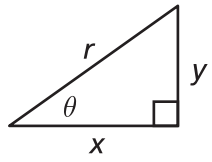
Trigonometric Functions

$\sin\theta = \frac{y}{r}$, $\csc\theta = \frac{r}{y}$

$\cos\theta = \frac{x}{r}$, $\sec\theta = \frac{r}{x}$

$\tan\theta = \frac{y}{x}$, $\cot\theta = \frac{x}{y}$



$r = \sqrt{x^2 + y^2}$

Logarithm Properties

$\log_b MN = \log_b M + \log_b N$

$\log_b\left(\frac{M}{N}\right) = \log_b M - \log_b N$

$\log_b M^p = p \log_b M$

$\log_b x = y \Leftrightarrow x = b^y$

Arithmetic and Geometric Sequences and Series

$a_1 = 1^{st}$ term $\quad r =$ common ratio $\quad d =$ common difference

$a_n = n^{th}$ term $\quad n =$ number of terms in series

Arithmetic Sequence: $a_n = a_1 + (n-1)d$ Geometric Sequence: $a_n = a_1 r^{n-1}$

Sum of a Finite Arithmetic Series: $S_n = \frac{n(a_1 + a_n)}{2}$ or $S_n = \frac{1}{2}n[2a_1 + (n-1)d]$

Sum of a Finite Geometric Series: $S_n = \frac{a_1(1-r^n)}{1-r}$, $r \neq 1$

Sum of an Infinite Geometric Series: $S = \frac{a_1}{1-r}$ where $|r| < 1$

Combinations

$${}_nC_r = \frac{n!}{r!(n-r)!}$$

Permutations

$${}_nP_r = \frac{n!}{(n-r)!}$$

Binomial Theorem

$$(a+b)^n = \sum_{r=0}^{n} \binom{n}{r} a^{n-r} b^r$$

Quadratic Formula

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$y = ax^2 + bx + c$

Interest Formulas

Compound interest: $A = P\left(1 + \frac{r}{n}\right)^{nt}$

Continuous compound interest: $A = Pe^{rt}$

$P =$ present value

$A =$ future value

$r =$ annual interest rate

$t =$ time in years

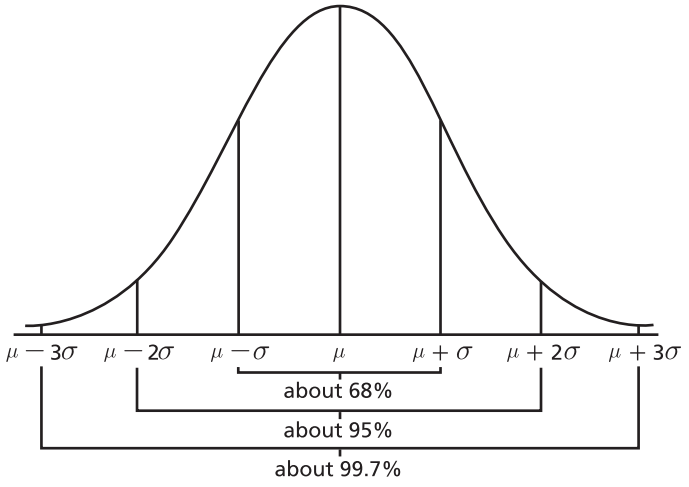
$n =$ frequency of compounding per year

Algebra II Reference Page

Conic Sections – Standard Equations

Parabola	$y = a(x-h)^2 + k$	or	$x = a(y-k)^2 + h$
	$(y-k)^2 = 4p(x-h)$	or	$(x-h)^2 = 4p(y-k)$
Circle	$(x-h)^2 + (y-k)^2 = r^2$		
Ellipse	$\frac{(x-h)^2}{a^2} + \frac{(y-k)^2}{b^2} = 1$	or	$\frac{(x-h)^2}{b^2} + \frac{(y-k)^2}{a^2} = 1$
Hyperbola	$\frac{(x-h)^2}{a^2} - \frac{(y-k)^2}{b^2} = 1$	or	$\frac{(y-k)^2}{a^2} - \frac{(x-h)^2}{b^2} = 1$

Normal Curve Distribution



Standard Deviation

The standard deviation , σ, for values $x_1, x_2, x_3, \ldots, x_n$ with mean μ is determined by the following:

$$\sigma = \sqrt{\frac{(x_1 - \mu)^2 + (x_2 - \mu)^2 + \ldots + (x_n - \mu)^2}{n}}$$

Probability Formulas

Exclusive

$$P(A \text{ or } B) = P(A) + P(B)$$

Inclusive

$$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$$

Independent

$$P(A \text{ and } B) = P(A) \bullet P(B)$$

Dependent

$$P(A \text{ and } B) = P(A) \bullet P(B|A)$$

Conditional

$$P(B|A) = \frac{P(A \text{ and } B)}{P(A)}$$

Algebra II Reference Page

Cramer's Rule for Solving a System of Linear Equations

For a 2×2 System:

$$a_1x + b_1y = c_1$$
$$a_2x + b_2y = c_2$$

$$x = \frac{\begin{vmatrix} c_1 & b_1 \\ c_2 & b_2 \end{vmatrix}}{\begin{vmatrix} a_1 & b_1 \\ a_2 & b_2 \end{vmatrix}} \qquad y = \frac{\begin{vmatrix} a_1 & c_1 \\ a_2 & c_2 \end{vmatrix}}{\begin{vmatrix} a_1 & b_1 \\ a_2 & b_2 \end{vmatrix}}$$

For a 3×3 System:

$$a_1x + b_1y + c_1z = d_1$$
$$a_2x + b_2y + c_2z = d_2$$
$$a_3x + b_3y + c_3z = d_3$$

$$x = \frac{\begin{vmatrix} d_1 & b_1 & c_1 \\ d_2 & b_2 & c_2 \\ d_3 & b_3 & c_3 \end{vmatrix}}{\begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix}} \qquad y = \frac{\begin{vmatrix} a_1 & d_1 & c_1 \\ a_2 & d_2 & c_2 \\ a_3 & d_3 & c_3 \end{vmatrix}}{\begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix}} \qquad z = \frac{\begin{vmatrix} a_1 & b_1 & d_1 \\ a_2 & b_2 & d_2 \\ a_3 & b_3 & d_3 \end{vmatrix}}{\begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix}}$$

Converting Degrees to Radians

Multiply degree measure by $\frac{\pi}{180°}$

Converting Radians to Degrees

Multiply radian measure by $\frac{180°}{\pi}$

Definition of "i"

$$i^2 = -1$$
$$i = \sqrt{-1}$$

Absolute Value of a Complex Number

$$|a + bi| = \sqrt{a^2 + b^2}$$

Contents

Introduction to Algebra II

Content of tests

The testing program titled the *Tennessee End of Course Assessment* was established to meet the Tennessee mandate for end of course assessments in Tennessee secondary schools. These tests measure the Tennessee Performance Indicators. Subject areas covered by the testing program include Mathematics, Language Arts, History, and Science.

Test development

For the *Tennessee End of Course Assessment*, a staff of writers—composed of both teachers and professional test developers experienced in each of the content areas—researched and wrote the items. Professional editors and content specialists carefully reviewed all items and test directions for content and accuracy. To provide a large pool of items for final test selection, the test developers created approximately twice as many items as were needed in the final editions of the tests.

After tryout tests were administered, student responses were analyzed. Professional content editors and researchers carefully reviewed items, their data, and test directions for content, suitability, and accuracy before including particular items and test directions in operational tests.

Test administration

Tennessee End of Course Assessments are given to students as they near the end of courses that are included in the program. Tests may be given midyear for block schedules or near the end of the school year.

This test contains 65 multiple-choice questions.

You will have ample time to read and answer each of the questions. The Algebra II test has been designed to be administered in one session and is not timed. The first 15 minutes are set aside to complete identifying data on the answer sheet.

Calculator use is recommended. Sharing calculators during testing is not permitted.

The following types of calculators/devices may **NOT** be used during the test:

- pocket organizers
- electronic writing pads or input devices
- Some examples of prohibited calculators are:
  - Casio models: CFX-9970G, Algebra FX 2.0
  - Hewlett-Packard models: HP-40G, HP-49G
  - Texas Instruments models: TI-89, TI-92, Voyage 200, TI-NSPIRE - the CAS version (The non-CAS version of TI-NSPIRE is allowable.)
- calculators that can communicate (transfer data or information) wirelessly with other student calculators/devices
- cell phones, PSPs, and/or iPods

Students may use any four-function, scientific, or graphing calculator that does not have any of the above features. The use of devices that have a Computer Algebra System (CAS) is NOT allowed.

Tips for Taking the Test

Preparing for the test

- Review this Tennessee End of Course Item Sampler for Algebra II carefully and thoroughly.
- Acquire a Tennessee End of Course Practice Test for Algebra II, and take the test several times.
- Become familiar with the correct way to mark answers on the answer sheet. There is a sample answer sheet in the Practice Test.

Before the test

- Get a good night's sleep. To do your best, you need to be rested.

During the test

- Relax. It is normal to be somewhat nervous before the test. Try to relax and not worry.
- Listen. Listen to and read the test directions carefully. Ask for an explanation of the directions if you do not understand them.
- Plan your time. Do not spend too much time on any one question. If a question seems to take too long, skip it and return to it later. Answer all questions you are sure of first.
- Think. If you are not sure how to answer a question, read it again and try your best to answer the question. Rule out answer choices that you know are incorrect and choose from those that remain.

Directions for Using the Item Sampler

This Item Sampler for Algebra II provides specific information to students and teachers. It contains examples of different item types for each Performance Indicator that may be tested in any given end of course test administration. Performance Indicators have been grouped under Reporting Categories. These Reporting Categories will be used to report information regarding performance on the end of course tests to students, teachers, schools, and systems.

The items in this Item Sampler will not be found in the end of course tests. The number of items in this Item Sampler does not reflect the emphasis of content on the test. In order to identify the emphasis of content, the End of Course Assessment Practice Test for Algebra II should be used. The Practice Test gives a better representation of content emphasis across Reporting Categories and Performance Indicators.

An Answer Key is located on Page 33. Use it to check your answers. Review items that you get wrong.

Reporting Category: Mathematical Processes

Performance Indicator: Move flexibly between multiple representations (contextual, physical, written, verbal, iconic/pictorial, graphical, tabular, and symbolic) of nonlinear and transcendental functions to solve problems, to model mathematical ideas, and to communicate solution strategies.

1 Which table of values is best represented by the equation below?

$$y = 5(0.3)^x$$

x	*y*
0	5
0.5	2.7
1	1.5
1.5	0.8
2	0.5

A

x	*y*
0	5
0.5	1.5
1	0.5
1.5	0.1
2	0

C

x	*y*
0	0.3
0.5	0.7
1	1.5
1.5	3.4
2	7.5

B

x	*y*
0	1
0.5	1.2
1	1.5
1.5	1.8
2	2.3

D

GM050907

Go On ▶

Performance Indicator: Recognize and describe errors in data collection and analysis as well as identifying representations of data as being accurate or misleading.

2 A manufacturer is trying to determine how to test a product for safety. Which method would best determine that the product is safe?

F test every unit of the product from one manufacturing plant

G test every unit of the product made on a particular day

H test randomly selected units of the product made in all manufacturing plants

J test randomly selected units of the product from one manufacturing plant

GM050610

Performance Indicator: Use technology tools to identify and describe patterns in data using nonlinear and transcendental functions that approximate data as well as using those functions to solve contextual problems.

3 This table displays the results of an experiment on exponential decay.

x	*y*
–4	63
–2	17
–1	8
0	5
2	1.5
3	0.7
4	0.3

Based on these results, which is closest to the expected value of y if $x = 1.5$?

A 3.5

B 3.25

C 3.0

D 1.75

GM050215

Performance Indicator: Use mathematical language, symbols, definitions, proofs and counterexamples correctly and precisely to effectively communicate reasoning in the process of solving problems via mathematical modeling with both linear and nonlinear functions.

4 Matthew showed the following steps in solving a problem. In which step did Matthew's mistake first appear?

$$x^2 + 8x - 9 = 0$$

Step 1: $x^2 + 8x = 9$

Step 2: $x^2 + 8x + 16 = 9 + 16$

Step 3: $(x + 4)^2 = 25$

Step 4: $x + 4 = 5$

Step 5: $x = 1$

F Step 2

G Step 3

H Step 4

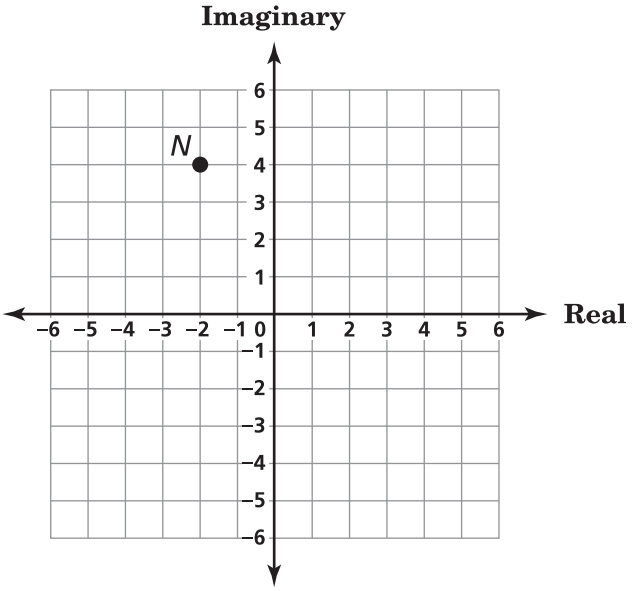
J Step 5

GM050746

Reporting Category: Number & Operations

Performance Indicator: Describe any number in the complex number system.

5 The grid below represents a complex plane.



What is the conjugate of the complex number represented by Point *N*?

A $4 - 2i$

B $4 + 2i$

C $-2 - 4i$

D $-2 + 4i$

GM050968

Performance Indicator: Compute with all real and complex numbers.

6 Which is equivalent to $(6 + 3i)(6 - 3i)$?

F 45

G $36 + 9i$

H $36 - 9i$

J 27

GM050229

Performance Indicator: Use the number system, from real to complex, to solve equations and contextual problems.

7 What value of x makes this equation true?

$$-5(x + 10)^{\frac{7}{2}} = -390{,}625$$

A 5

B 15

C 25

D 35

GM050375

Go On ▶

Reporting Category: Algebra

Performance Indicator: Add, subtract, and multiply polynomials; divide a polynomial by a lower degree polynomial.

8 Which polynomial is equivalent to $\left(3k^3 + 2k - 11\right) - \left(-k^3 - 6k + 8\right)$?

F $2k^3 - 4k - 3$

G $2k^3 + 8k - 19$

H $4k^3 - 4k - 3$

J $4k^3 + 8k - 19$

GM050290

Performance Indicator: Solve quadratic equations and systems, and determine roots of a higher order polynomial.

9 Which ordered pair represents a solution to this system of equations?

$$y = 3x^2 - 3x - 20$$
$$y = 2x + 8$$

A $(16, 4)$

B $(4, 16)$

C $(4, 0)$

D $(0, 4)$

GM050334

Performance Indicator: Add, subtract, multiply, divide, and simplify rational expressions including those with rational and negative exponents.

10 Which expression is equivalent to $\left(\frac{64x^{\frac{4}{3}}y}{25x^{\frac{2}{3}}y^{\frac{1}{2}}}\right)^{\frac{1}{2}}$ for all $x, y \neq 0$?

F $\frac{8}{5}x^2y^2$

G $\frac{8}{5}x^{\frac{7}{6}}y$

H $\frac{8}{5}x^{\frac{1}{3}}y^{\frac{1}{4}}$

J $\frac{8}{5}x^{\frac{2}{3}}y^{\frac{1}{2}}$

GM050718

Performance Indicator: Use the formulas for the general term and summation of finite arithmetic and both finite and infinite geometric series.

11 Given: $S = \frac{a_1}{1-r}$ where $|r| < 1$

What is the sum of the following infinite geometric series?

$$16 - 6 + \frac{9}{4} - \frac{27}{32} + \ldots$$

A $\frac{131}{8}$

B $\frac{56}{3}$

C $\frac{48}{11}$

D $\frac{128}{11}$

GM050368

Performance Indicator: Describe the domain and range of functions and articulate restrictions imposed either by the operations or by the contextual situations which the functions represent.

12 What is the range of $f(x) = 25x^2 - 30x + 16$?

F $y \geq 16$

G $y \geq 7$

H $y \geq \frac{16}{25}$

J $y \geq \frac{3}{5}$

GM050264

Performance Indicator: Combine functions (such as polynomial, rational, radical, and absolute value expressions) by addition, subtraction, multiplication, division, or by composition and evaluate at specified values of their variables.

13 Given:

$$f(x) = x^2 - 3x \text{ and } g(x) = 2x + 9$$

Which polynomial represents $g(f(x))$?

A $x^2 - x + 9$

B $2x^2 - 6x + 9$

C $4x^2 + 30x + 54$

D $2x^3 + 3x^2 - 27x$

GM050930

Performance Indicator: Identify whether a function has an inverse, whether two functions are inverses of each other, and/or explain why their graphs are reflections over the line y = x.

14 What is $g(x)$, the inverse of the function $f(x) = (x-8)^{\frac{2}{3}}$ for all $x \geq 8$?

F $g(x) = \dfrac{1}{(x-8)^{\frac{2}{3}}},\ x \geq 8$

G $g(x) = x^{\frac{3}{2}} + 8,\ x \geq 0$

H $g(x) = (x-8)^{\frac{3}{2}},\ x \geq 8$

J $g(x) = x^{\frac{2}{3}} + 8,\ x \geq 0$

GM050728

Performance Indicator: Solve systems of three linear equations in three variables.

15 Which is the solution (x, y, z) to the following system of equations?

$$2x + 3y - 4z = -5$$
$$6x + y + 2z = 19$$
$$2x - y - z = 0$$

A $(-2, 1, 1)$

B $(3, -3, 2)$

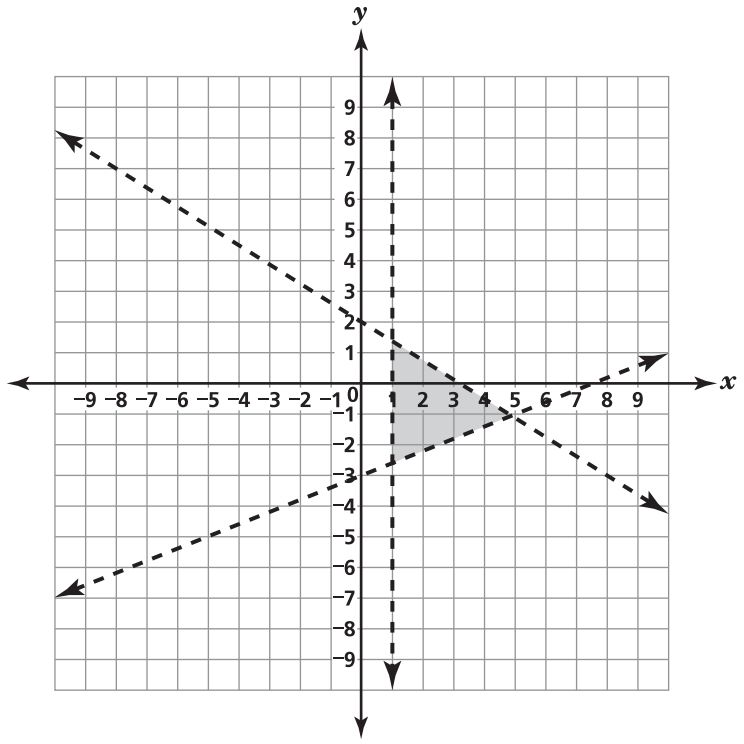
C $(3, 1, 2)$

D $(2, 1, 3)$

GM050754

Performance Indicator: Graph the solution set of two or three linear or quadratic inequalities.

16 Which system of inequalities is best represented by the shaded region of this graph?



F $\begin{cases} 8x + 5y > 10 \\ 5x - 2y > 6 \\ x > 1 \end{cases}$

G $\begin{cases} 8x + 5y < 10 \\ 5x - 2y < 6 \\ x > 1 \end{cases}$

H $\begin{cases} 5x + 8y < 16 \\ 2x - 5y < 15 \\ x > 1 \end{cases}$

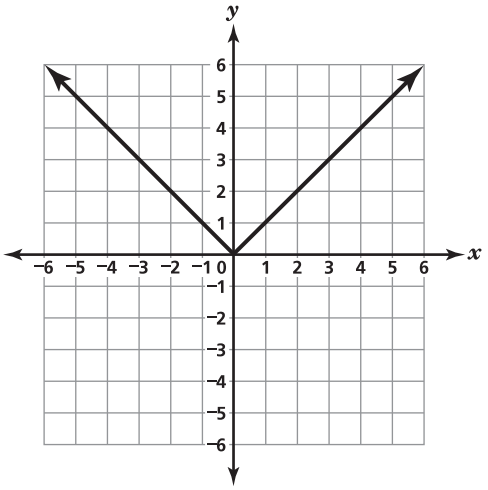
J $\begin{cases} 5x + 8y > 16 \\ 2x - 5y > 15 \\ x > 1 \end{cases}$

GM050275

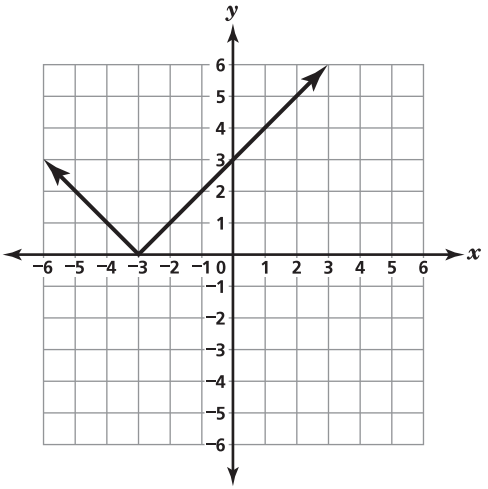
Go On ▶

Performance Indicator: Identify and/or graph a variety of functions and their transformations.

17 The parent absolute value function, $f(x) = |x|$, is transformed so that the transformed function is defined as $f(x) = 3|x|$. Which graph could represent this transformed function?



A



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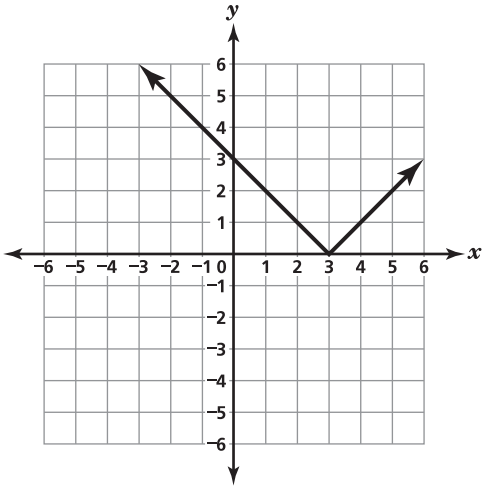
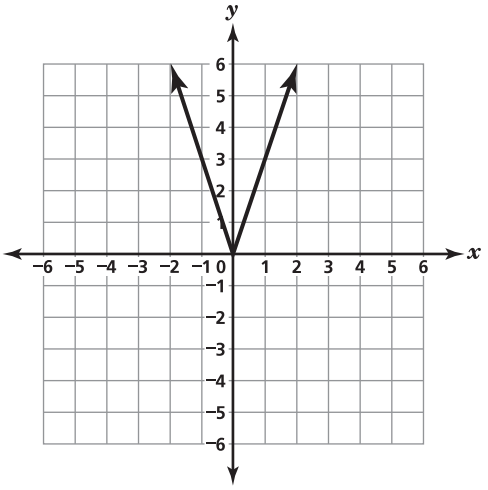


B

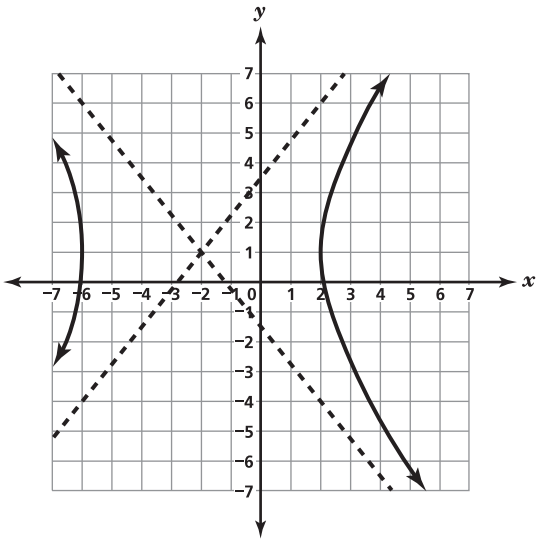


D

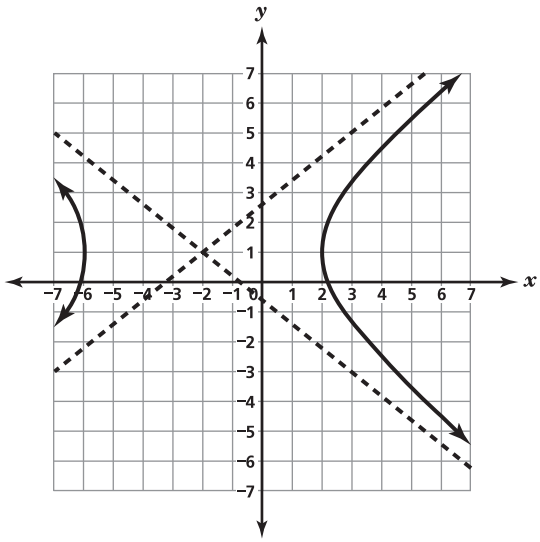
GM050757

Performance Indicator: Graph conic sections (circles, parabolas, ellipses and hyperbolas) and understand the relationship between the standard form and the key characteristics of the graph.

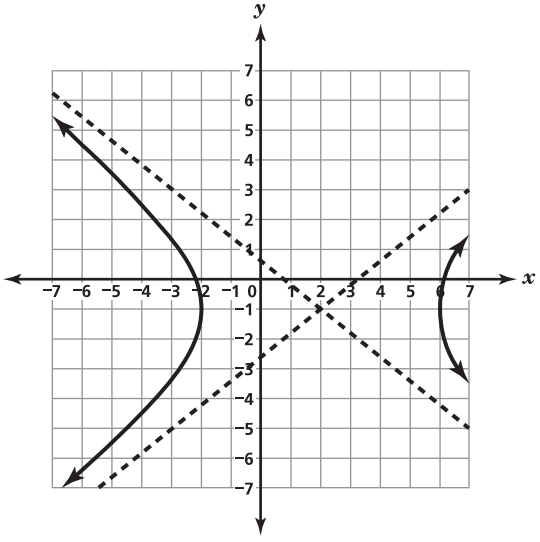
18 Which graph best represents $\frac{(x+2)^2}{16} - \frac{(y-1)^2}{25} = 1$?



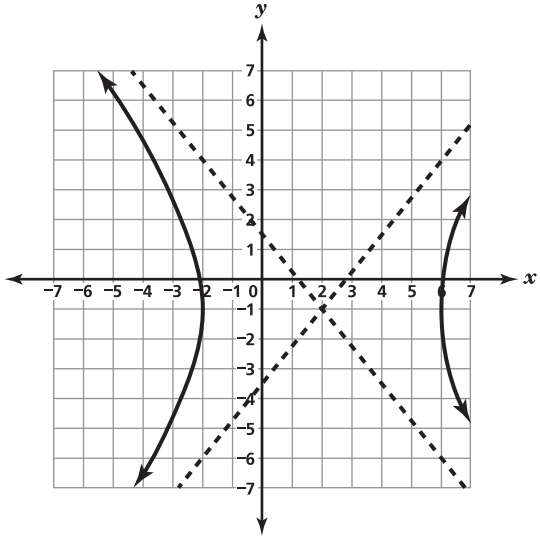
F



H



G

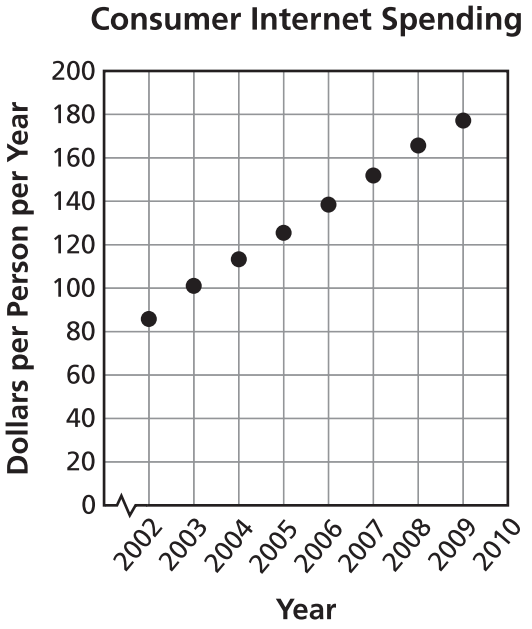


J

GM050295

Performance Indicator: Interpret graphs that depict real-world phenomena.

19 The graph shows the average amount, in dollars, of consumer spending per person per year on the Internet.



Which statement is best supported by the data in the graph?

A The amount spent per person in 2005 was about half of that spent in 2009.

B The amount spent per person in 2008 was about twice as much as that spent in 2002.

C The median amount spent per person per year over the years 2002 to 2009 is approximately $85.

D The range of the amount spent per person per year over the years 2002 to 2009 is approximately $180.

GM050861

Performance Indicator: Solve contextual problems using quadratic, rational, radical and exponential equations, finite geometric series, or systems of equations.

20 The equivalent resistance, R_{eq}, in ohms, to a parallel electric circuit with two resistors measuring R_1 and R_2 ohms can be determined using the equation below.

$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2}$$

Laura created a parallel electric circuit with $R_{eq} = 24$ ohms. The resistance of R_2 is 20 ohms greater than R_1. What is the value, in ohms, of R_1?

F 2
G 12
H 40
J 48

GM050693

Performance Indicator: Solve problems involving the binomial theorem and its connection to Pascal's Triangle, combinatorics, and probability.

21 What is the coefficient of the fourth term in the binomial expansion of $\left(1 + 2x^2\right)^5$?

A 8
B 10
C 80
D 160

GM050659

Reporting Category: Geometry & Measurement

Performance Indicator: Exhibit knowledge of unit circle trigonometry.

22 What is the exact value of $\sec\left(-\frac{\pi}{3}\right)$?

F -2

G $-\frac{1}{2}$

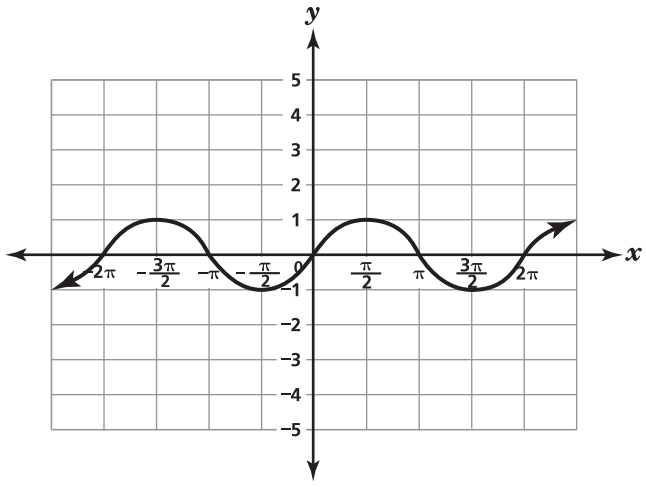
H $\frac{1}{2}$

J 2

GM050399

Performance Indicator: Match graphs of basic trigonometric functions with their equations.

23 Consider the graph below.



Which function is best represented by this graph?

A $f(x) = \cos x$

B $f(x) = \cot x$

C $f(x) = \sin x$

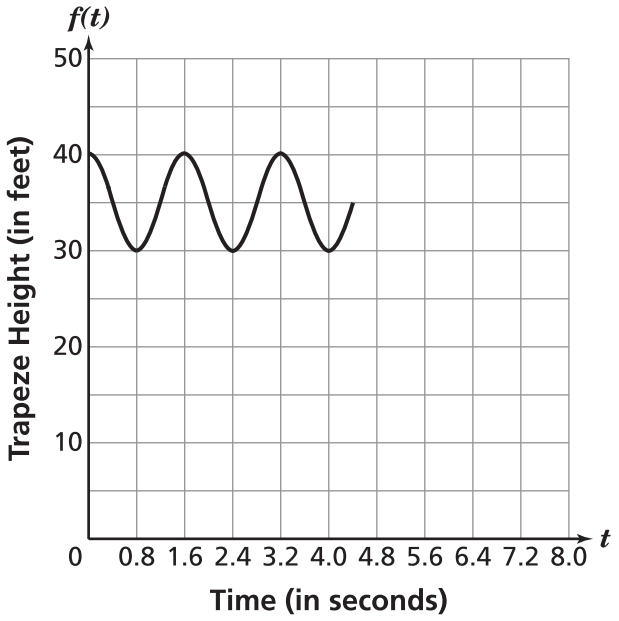
D $f(x) = \tan x$

GM050836

Go On ▶

Performance Indicator: Describe and articulate the characteristics and parameters of parent trigonometric functions to solve contextual problems.

24 The height, in feet, of a swinging trapeze over time, in seconds, is modeled by the graph shown below.



A function describing this graph is a transformation of the parent cosine function, $y = \cos x$. Which value best describes the amplitude for this transformed function?

F 5 feet
G 10 feet
H 35 feet
J 40 feet

TEA210001

Reporting Category: Data Analysis, Statistics, & Probability

Performance Indicator: Compute, compare, and explain summary statistics for distributions of data including measures of center and spread.

25 A city official collected data on the heights of all the office buildings in the business district. The heights of the buildings, in feet (ft), are as follows:

51, 63, 74, 76, 81, 82, 85, 89, 91, 92, 95

Which is closest to the value of the standard deviation of the heights of these office buildings?

A 8.9 ft
B 12.7 ft
C 79.9 ft
D 162.1 ft

GM050559

Performance Indicator: Compare data sets using graphs and summary statistics.

26 Cindy and Elena each performed in 6 events at a competition. Their scores for these events are listed below.

Cindy: 70, 77, 73, 73, 71, 86
Elena: 85, 71, 72, 72, 85, 71

Which statement best compares Cindy's scores to Elena's scores?

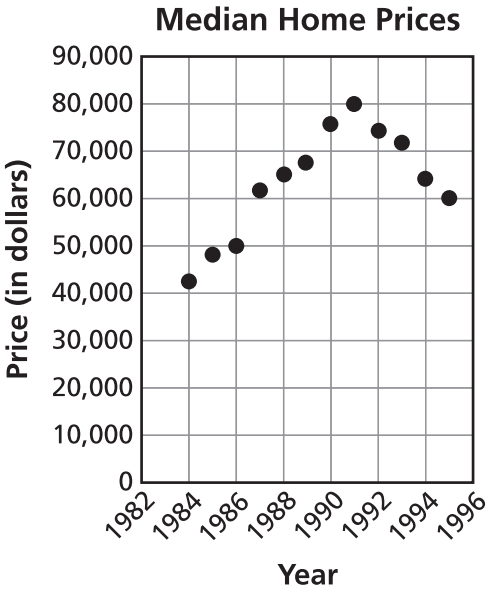
F Cindy's scores have a smaller mean and a smaller standard deviation than Elena's scores.
G Cindy's scores have a smaller mean but a larger standard deviation than Elena's scores.
H Cindy's scores have a larger mean but a smaller standard deviation than Elena's scores.
J Cindy's scores have a larger mean and a larger standard deviation than Elena's scores.

GM050892

Go On ▶

Performance Indicator: Analyze patterns in a scatterplot and describe relationships in both linear and nonlinear data.

27 The scatterplot below shows the median home prices in a certain town over a 14-year period.



Which type of function do these data points best fit?

A quadratic
B logarithmic
C linear
D exponential

GM050819

Performance Indicator: Apply the characteristics of the normal distribution.

28 The mean of a normal distribution is 20 with a standard deviation of 3. If a value is randomly selected from this distribution, which is closest to the probability that the selected value is less than or equal to 26?

F 0.475
G 0.68
H 0.95
J 0.975

GM050621

Go On ▶

Performance Indicator: Determine differences between randomized experiments and observational studies.

29 A research team is conducting the following research projects:

Project I — Does taking vitamins decrease the chance of getting sick?

Project II — Do more people in rural areas have vegetable gardens?

Project III — Does using a certain brand of lotion improve dry skin?

Project IV — Do people who listen to classical music have better test scores?

Which of the projects would best be conducted using an observational study instead of a randomized experiment?

A Project I

B Project II

C Project III

D Project IV

GM050676

Performance Indicator: Find the regression curve that best fits both linear and nonlinear data (using technology such as a graphing calculator) and use it to make predictions.

30 The table shows the number of compact discs (CDs), in millions, shipped each year by manufacturers.

Number of CDs Shipped by Manufacturers

Year	1993	1994	1995	1996	1997
Number of CDs (in millions)	7.8	9.3	21.5	43.2	66.7

Assuming exponential growth, which is the most reasonable estimate for the number of CDs shipped in 1999?

F 220 million

G 120 million

H 87 million

J 75 million

GM050794

Go On ▶

Performance Indicator: Determine/recognize when the correlation coefficient measures goodness of fit.

31 Which correlation coefficient indicates the stronger linear relationship between two random variables for a fixed sample size?

A 0.7
B 0.2
C −0.1
D −0.8

GM050712

Performance Indicator: Apply probability concepts such as conditional probability and independent events to calculate simple probability.

32 A teacher randomly shuffled a pile of 45 mathematics flash cards, with one problem per flash card. The table shows the number of flash cards of each type and difficulty level.

	Easy	Hard
Algebra	8	19
Geometry	6	12

Given that the top flash card in the pile is easy, what is the probability that it is a geometry flash card?

F $\frac{2}{15}$

G $\frac{1}{3}$

H $\frac{2}{5}$

J $\frac{3}{7}$

GM050699

STOP

Reporting Category 1: Mathematical Processes		
Item Number	**Correct Answer**	**Performance Indicator**
1	**A**	3103.1.1 Move flexibly between multiple representations (contextual, physical, written, verbal, iconic/pictorial, graphical, tabular, and symbolic) of nonlinear and transcendental functions to solve problems, to model mathematical ideas, and to communicate solution strategies.
2	**H**	3103.1.2 Recognize and describe errors in data collection and analysis as well as identifying representations of data as being accurate or misleading.
3	**D**	3103.1.3 Use technology tools to identify and describe patterns in data using nonlinear and transcendental functions that approximate data as well as using those functions to solve contextual problems.
4	**H**	3103.1.4 Use mathematical language, symbols, definitions, proofs and counterexamples correctly and precisely to effectively communicate reasoning in the process of solving problems via mathematical modeling with both linear and nonlinear functions.

Reporting Category 2: Number & Operations		
Item Number	**Correct Answer**	**Performance Indicator**
5	**C**	3103.2.1 Describe any number in the complex number system.
6	**F**	3103.2.2 Compute with all real and complex numbers.
7	**B**	3103.2.3 Use the number system, from real to complex, to solve equations and contextual problems.

Reporting Category 3: Algebra		
Item Number	**Correct Answer**	**Performance Indicator**
8	**J**	3103.3.1 Add, subtract, and multiply polynomials; divide a polynomial by a lower degree polynomial.
9	**B**	3103.3.2 Solve quadratic equations and systems, and determine roots of a higher order polynomial.
10	**H**	3103.3.3 Add, subtract, multiply, divide, and simplify rational expressions including those with rational and negative exponents.
11	**D**	3103.3.4 Use the formulas for the general term and summation of finite arithmetic and both finite and infinite geometric series.
12	**G**	3103.3.5 Describe the domain and range of functions and articulate restrictions imposed either by the operations or by the contextual situations which the functions represent.
13	**B**	3103.3.6 Combine functions (such as polynomial, rational, radical, and absolute value expressions) by addition, subtraction, multiplication, division, or by composition and evaluate at specified values of their variables.
14	**G**	3103.3.7 Identify whether a function has an inverse, whether two functions are inverses of each other, and/or explain why their graphs are reflections over the line y = x.
15	**D**	3103.3.8 Solve systems of three linear equations in three variables.
16	**H**	3103.3.9 Graph the solution set of two or three linear or quadratic inequalities.
17	**D**	3103.3.10 Identify and/or graph a variety of functions and their transformations.
18	**F**	3103.3.11 Graph conic sections (circles, parabolas, ellipses and hyperbolas) and understand the relationship between the standard form and the key characteristics of the graph.
19	**B**	3103.3.12 Interpret graphs that depict real-world phenomena.
20	**H**	3103.3.13 Solve contextual problems using quadratic, rational, radical and exponential equations, finite geometric series, or systems of equations.
21	**C**	3103.3.14 Solve problems involving the binomial theorem and its connection to Pascal's Triangle, combinatorics, and probability.

Reporting Category 4: Geometry & Measurement		
Item Number	**Correct Answer**	**Performance Indicator**
22	**J**	3103.4.1 Exhibit knowledge of unit circle trigonometry.
23	**C**	3103.4.2 Match graphs of basic trigonometric functions with their equations.
24	**F**	3103.4.3 Describe and articulate the characteristics and parameters of parent trigonometric functions to solve contextual problems.

Reporting Category 5: Data Analysis, Statistics, & Probability		
Item Number	**Correct Answer**	**Performance Indicator**
25	**B**	3103.5.1 Compute, compare, and explain summary statistics for distributions of data including measures of center and spread.
26	**F**	3103.5.2 Compare data sets using graphs and summary statistics.
27	**A**	3103.5.3 Analyze patterns in a scatterplot and describe relationships in both linear and nonlinear data.
28	**J**	3103.5.4 Apply the characteristics of the normal distribution.
29	**B**	3103.5.5 Determine differences between randomized experiments and observational studies.
30	**F**	3103.5.6 Find the regression curve that best fits both linear and nonlinear data (using technology such as a graphing calculator) and use it to make predictions.
31	**D**	3103.5.7 Determine/recognize when the correlation coefficient measures goodness of fit.
32	**J**	3103.5.8 Apply probability concepts such as conditional probability and independent events to calculate simple probability.